

April 23, 1940.

A. J. WEINIG

2,198,143

AERATION APPARATUS

Filed April 4, 1938

2 Sheets-Sheet 1

Fig. 2.

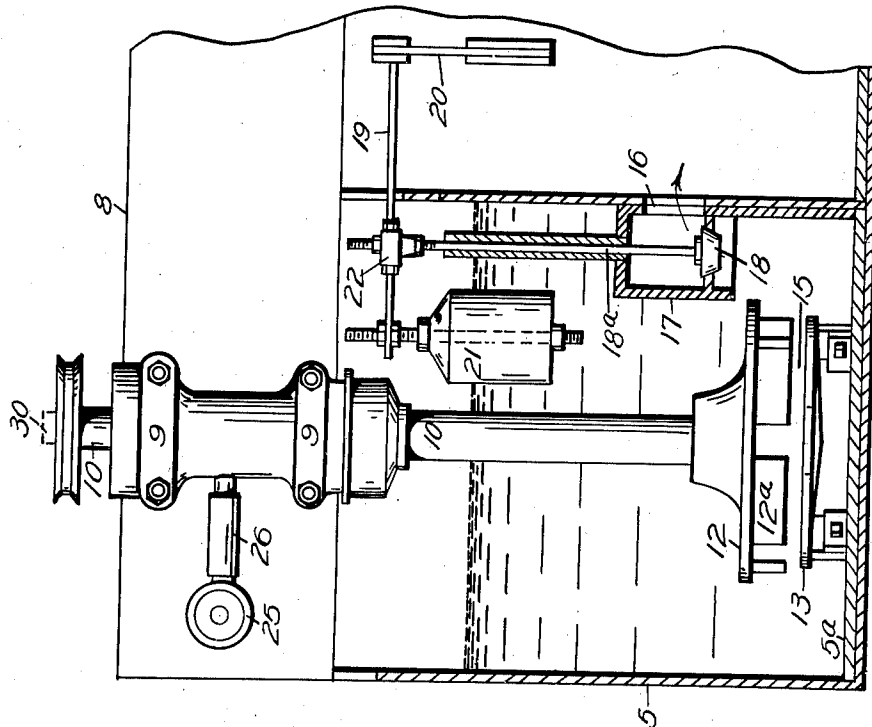
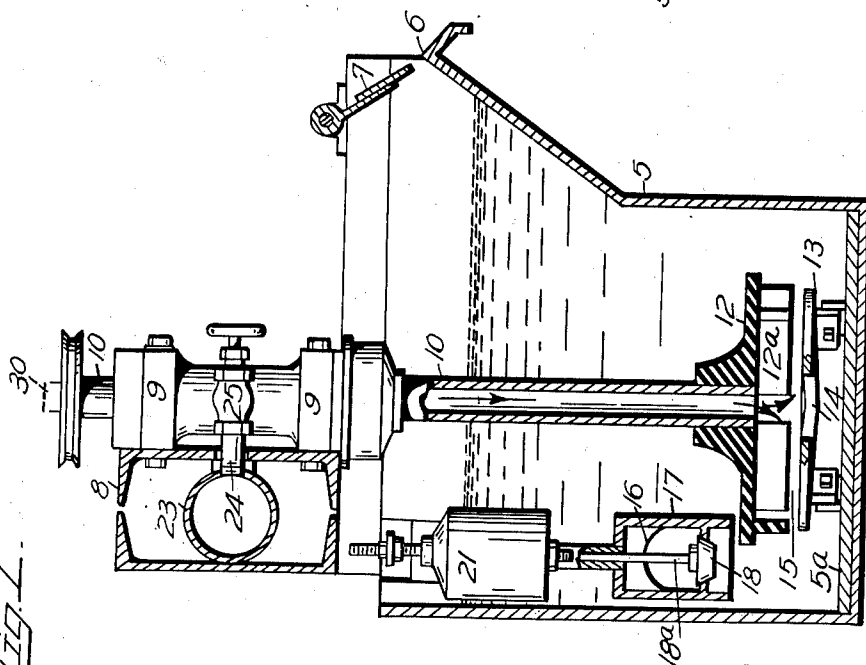


Fig. 1.



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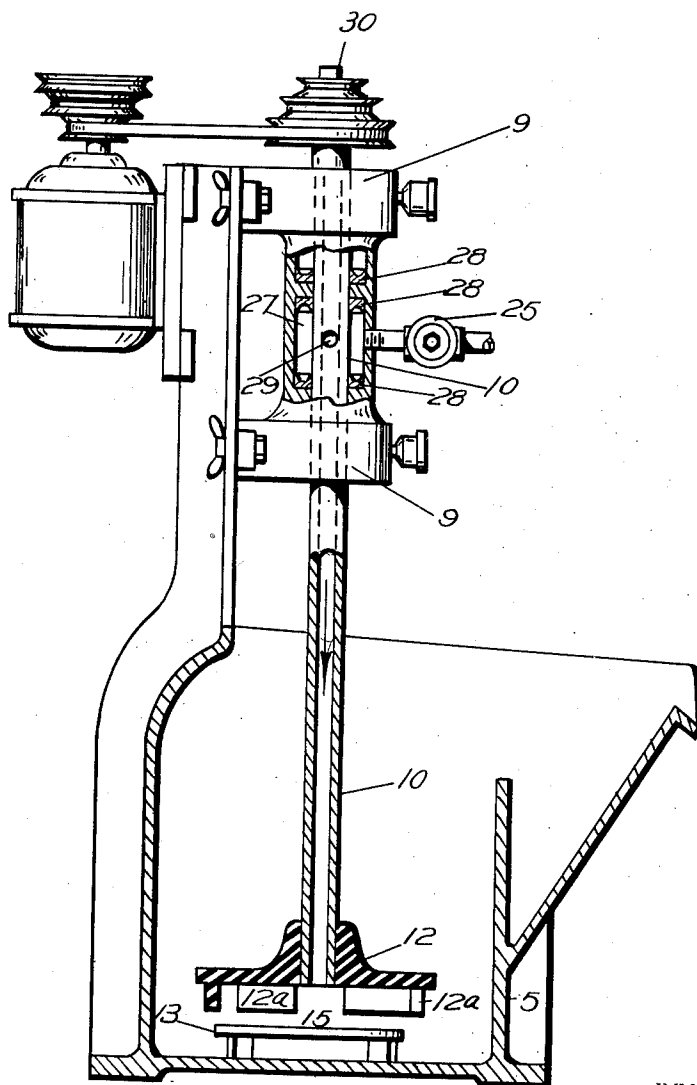


Fig. 3.

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UNITED STATES PATENT OFFICE

2,198,143

AERATION APPARATUS

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Application April 4, 1938, Serial No. 199,883

1 Claim. (Cl. 261—87)

This invention relates to improvements in flotation apparatus, and more particularly to improved means for aeration of liquid pulp.

Different flotation reagents and pulps of different characteristics require different types and degrees of aeration for optimum results. Further, different altitudes at which flotation apparatus may be operated may require different types of and means for aeration, even when other factors remain the same.

It is an object of the present invention to provide improved means for aeration, in flotation apparatus, that may be used to vary the degree and type of aeration according to operating conditions, thus providing apparatus of this character that may be sold for general use and that is adaptable to a wide range of operating requirements.

Other objects and advantages reside in details of design and construction that will be more fully disclosed in the following description and in the drawings wherein;

Figure 1 is a transverse sectional view of apparatus constructed according to the present invention;

Figure 2 is a longitudinal fragmentary sectional view of the same; and

Figure 3 is a sectional view of a laboratory type apparatus built according to the invention.

In the drawings, reference character 5 denotes a conventional flotation cell, having a froth discharge lip at 6 and a rotary froth skimmer or paddle 7. Above the cell is positioned suitable superstructure 8 that supports a pair of spaced bearings 9, that journal a vertical hollow shaft 10 that carries an impeller, preferably of the open type, as shown at 12.

The impeller is of the general design disclosed and claimed in the United States patent to A. J. Weinig, No. 1,998,694, issued April 23, 1935. In the present case it has been shown as constructed of rubber, which feature is not a part of the present invention.

Below the impeller 12, that is provided with vanes 12a, is a disk-like plate 13 having a central opening 14, the disk serving to provide a lower closure for a pumping or suction zone 15. The arrangement of the vanes 12a on the under side of the impeller is in group formation. Each group performs a distinctive function in the operation of the impeller. One inner group of vanes is arranged radially to serve as pumping or suction vanes and impart a centrifugal component of force to the adjacent pulp thus tending to throw it outwardly from the impeller and at the

same time create a vortex at the center of rotation to aid in sucking air or other gas, down through the hollow shaft 10 and into the pulp, as indicated by the arrows. Any common means may be used to rotate the shaft.

Another group of vanes is arranged as chords near the periphery of the circular impeller, and these serve to slice across the pulp and to draw it inwardly. Thus a zone of intense agitation is set up at and near the periphery of the impeller and air or other gas coming down through the hollow shaft 10 is thoroughly mixed with the pulp to rise through the quiescent zone above and, with the aid of the reagent, to form froth at the pulp surface and to float valuable constituents in a most efficient manner.

The disk-like closure plate 13 permits the impeller to be positioned above the cell bottom 5a so that when a shut-down occurs, the settlement of the solids from the pulp will form well below and to the sides of the impeller and will not interfere with its starting thereafter. Furthermore, the plate 13 tends to prevent settlement of solids directly under the impeller and to keep its zone of operation clear and free for the next start, and to facilitate its pumping action. It also helps to recirculate pulp through the agitation zone. The feature of the disk 13 is not the invention of the present applicant.

The cell 5 is provided with a discharge opening for the liquid pulp and for unfloatable solids therein, at 16, that is covered by a hood or compartment 17, the discharge of pulp into and through which is governed by the position of a valve element 18, in the compartment, that is operated by mechanism comprising a valve stem or rod 18a, a lever arm or beam 19 on a flexible fulcrum 20, and a float 21 depending from the lever arm 19 into the liquid pulp.

The valve stem 18a is pivotally and slidably connected with the lever arm 19 at 22. The object of the discharge control is to maintain a predetermined liquid level in the cell and the control means is similar to the apparatus disclosed and claimed in the copending application of A. J. Weinig, Serial No. 8,946, filed March 1, 1935 for Liquid level regulation apparatus.

Supported by the superstructure 8 is an air header 23 that conducts air or other gas under pressure from a source not shown. A branch line or nipple 24 is conductively tapped into the header and the flow of gas therethrough is manually controlled by means such as an angle valve 25 through which the air or gas may pass, thence through a flexible conduit such as a hose 26, into

an annular chamber 27 between the bearings 9.

Referring particularly to Figure 3, the details of the novel means of introducing air into the hollow shaft 10 are clearly illustrated. The chamber 27 surrounds a portion of the shaft 10, and annular sealing cups or rings 28 prevent escape or leakage of the air or gas around the shaft.

An opening 29 is provided through the shaft within the chamber 27 and provides a double inlet to the hollow interior thereof. A single inlet or more than two may be used. The pressure of the gas is sufficient to overcome the centrifugal influence of the shaft within the chamber, so that gas or air is forced into the hollow shaft and drawn downwardly by the combined influences of its pressure and the suction of the impeller 12. The amount and the pressure of air entering the pulp thus may be governed according to operating requirements which, as above pointed out, may vary. And since the factors entering into efficient flotation are easily disturbed, the control of air is of great importance. Some flotation operations require violent aeration, others effect better results through more gentle aeration.

A plug 30 is screwed into the upper end of the hollow shaft 10 to close it and prevent escape of air under pressure, therefrom. Under some conditions, the plug 30 may be removed and the valve 25 closed, in which case atmospheric air will be drawn down the shaft and into the pulp by the pumping action of the impeller. At low altitudes where the pressure and the specific gravity of the atmosphere are relatively high, the compressed air may, under certain conditions be dispensed with, and atmospheric air drawn in. But at higher altitudes, the atmospheric air has been found less satisfactory and air or gas under pressure is usually preferable for optimum results.

Obviously, the novel means for introducing air hereinabove described are very flexible and may be used with any type of flotation apparatus having mechanical agitation and with any closed type impeller. Other details of the apparatus and process may vary widely. Pulp may be fed into the cell 5 by any well known means such as a pulp chute, not shown, or it can be introduced through a feed compartment at an end wall. The novelty and improved utility of the present invention resides in the improved means for

supplying air or any aeration agent to and through the impeller under controllable conditions to meet various operating requirements.

Air or gas introduced through a jet at the bottom of a cell, beneath the impeller, as has been done, is not the equivalent of the present means of aeration, because in the present case, the air is intimately mixed with the liquid in fine bubbles whereas jet air may pass around to the side and avoid the impeller and rise through the liquid in fewer and larger bubbles. The difference may be of utmost importance in the results attained by a flotation operation. In the present case, air coming down through the hollow impeller shaft cannot escape the pumping and churning action of the impeller by which it is introduced into the zone of agitation.

Another advantage in the present construction over the prior art is the elimination of all air pipes entering through the bottom of the tank or elsewhere below the impeller. Such air pipes have the disadvantage of clogging and they are difficult to clean. They have the further disadvantage that they tend to drain a flotation cell when operation ceases. The present construction lends itself readily to cleaning as the hollow interior of the shaft is accessible for rod cleaning of any obstructions. The present construction obviously is more accessible for any service that may be required than is an aeration system located beneath a flotation machine.

What I claim and desire to secure by Letters Patent is:

The combination with aeration apparatus, inclusive of a rotary impeller on a rigid shaft provided with a gas delivery passage to the impeller extending the entire length of the shaft and journaled in two spaced bearings, and having an inlet to said passage intermediate said bearings, of a hollow housing for the bearings providing a chamber enclosing said inlet, valve control mechanism to introduce gas under pressure to the impeller during rotation thereof through the intermediary of said inlet and hollow shaft, and removable means for closing the upper open end of said hollow shaft, whereby gas under pressure may be introduced into the hollow shaft when the valve is open and atmospheric air drawn into the shaft when the upper end of the shaft is open and the valve closed.

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